

What is claimed is:

1. A high-purity high-hardness ultrafine-grain diamond sintered body having a grain size of 100 nm or less, which is produced by subjecting an ultrafine-grain natural diamond powder
5 having a grading range of zero to 0.1 μm to a desilication treatment, freeze-drying the desilicated powder in solution, and sintering the freeze-dried powder without a sintering aid.

2. The high-purity high-hardness ultrafine-grain diamond sintered body as defined in claim 1, which has light-transparency.

10 3. A method of producing a high-purity high-hardness ultrafine-grain diamond sintered body, comprising the steps of:

subjecting an ultrafine-grain natural diamond powder having a grading range of zero to 0.1 μm to a desilication treatment;

15 freeze-drying the desilicated powder in solution;

enclosing the freeze-dried powder in a Ta or Mo capsule; and

heating and pressurizing the capsule using an ultrahigh-pressure synthesizing apparatus at a temperature of 1700°C or more and under a pressure of 8.5 GPa or more, which meet the conditions for diamond to be thermodynamically stable, so as to sinter the freeze-dried
20 powder.

4. The method as defined in claim 3, wherein said heating and pressurizing step is performed at a temperature of 2150°C or more and under a pressure of 8.5 GPa or more, whereby the sintered body has light-transparency.